

# SEQUENCE LISTING

<110> NAKAMURA, Hirofumi  
NAKANE, Akitaka  
KUBOTA, Hidetoshi

<120> B-FRUCTOFURANOSIDASE VARIANTS

<130> 2006\_1464A

<140> US 10/591,751

<141> 2006-09-01

<150> JP 2004-060426

<151> 2004-03-04

<150> PCT/JP2005/003787

<151> 2005-03-04

<160> 18

<170> PatentIn version 3.3

<210> 1

<211> 1905

<212> DNA

<213> Aspergillus niger

<220>

<221> CDS

<222> (1)..(1905)

<400> 1

tca	tac	cac	ctg	gac	acc	acg	gcc	ccg	ccg	ccg	acc	aac	ctc	agc	acc	48
Ser	Tyr	His	Leu	Asp	Thr	Thr	Ala	Pro	Pro	Pro	Thr	Asn	Leu	Ser	Thr	
1			5					10					15			

ctc	ccc	aac	aac	acc	ctc	ttc	cac	gtg	tgg	cgg	ccg	cgc	gcg	cac	atc	96
Leu	Pro	Asn	Asn	Thr	Leu	Phe	His	Val	Trp	Arg	Pro	Arg	Ala	His	Ile	
			20					25					30			

ctg	ccc	gcc	gag	ggc	cag	atc	ggc	gac	ccc	tgc	gcg	cac	tac	acc	gac	144
Leu	Pro	Ala	Glu	Gly	Gln	Ile	Gly	Asp	Pro	Cys	Ala	His	Tyr	Thr	Asp	
		35					40					45				

cca	tcc	acc	ggc	ctc	ttc	cac	gtg	ggg	ttc	ctg	cac	gac	ggg	gac	ggc	192
Pro	Ser	Thr	Gly	Leu	Phe	His	Val	Gly	Phe	Leu	His	Asp	Gly	Asp	Gly	
	50					55					60					

atc	gcg	ggc	gcc	acc	acg	gcc	aac	ctg	gcc	acc	tac	acc	gat	acc	tcc	240
Ile	Ala	Gly	Ala	Thr	Thr	Ala	Asn	Leu	Ala	Thr	Tyr	Thr	Asp	Thr	Ser	
65				70				75						80		

gat	aac	ggg	agc	ttc	ctg	atc	cag	ccg	ggc	ggg	aag	aac	gac	ccc	gtc	288
Asp	Asn	Gly	Ser	Phe	Leu	Ile	Gln	Pro	Gly	Gly	Lys	Asn	Asp	Pro	Val	
			85					90						95		

gcc	gtg	ttc	gac	ggc	gcc	gtc	atc	ccc	gtc	ggc	gtc	aac	aac	acc	ccc	336
Ala	Val	Phe	Asp	Gly	Ala	Val	Ile	Pro	Val	Gly	Val	Asn	Asn	Thr	Pro	
			100					105					110			

acc	tta	ctc	tac	acc	tcc	gtc	tcc	ttc	ctg	ccc	atc	cac	tgg	tcc	atc	384
Thr	Leu	Leu	Tyr	Thr	Ser	Val	Ser	Phe	Leu	Pro	Ile	His	Trp	Ser	Ile	

115	120	125	
ccc tac acc cgc ggc agc gag acg cag tcg ttg gcc gtc gcg cgc gac Pro Tyr Thr Arg Gly Ser Glu Thr Gln Ser Leu Ala Val Ala Arg Asp	130	135	140
ggc ggc cgc cgc ttc gac aag ctc gac cag ggc ccc gtc atc gcc gac Gly Gly Arg Arg Phe Asp Lys Leu Asp Gln Gly Pro Val Ile Ala Asp	145	150	155
cac ccc ttc gcc gtc gac gtc acc gcc ttc cgc gat ccg ttt gtc ttc His Pro Phe Ala Val Asp Val Thr Ala Phe Arg Asp Pro Phe Val Phe	165	170	175
cgc agt gcc aag ttg gat gtg ctg ctg tcg ttg gat gag gag gtg gcg Arg Ser Ala Lys Leu Asp Val Leu Leu Ser Leu Asp Glu Glu Val Ala	180	185	190
cgg aat gag acg gcc gtg cag cag gcc gtc gat ggc tgg acc gag aag Arg Asn Glu Thr Ala Val Gln Gln Ala Val Asp Gly Trp Thr Glu Lys	195	200	205
aac gcc ccc tgg tat gtc gcg gtc tct ggc ggg gtg cac ggc gtc ggg Asn Ala Pro Trp Tyr Val Ala Val Ser Gly Gly Val His Gly Val Gly	210	215	220
ccc gcg cag ttc ctc tac cgc cag aac ggc ggg aac gct tcc gag ttc Pro Ala Gln Phe Leu Tyr Arg Gln Asn Gly Gly Asn Ala Ser Glu Phe	225	230	235
cag tac tgg gag tac ctc ggg gag tgg tgg cag gag gcg acc aac tcc Gln Tyr Trp Glu Tyr Leu Gly Glu Trp Trp Gln Glu Ala Thr Asn Ser	245	250	255
agc tgg ggc gac gag ggc acc tgg gcc ggg cgc tgg ggg ttc aac ttc Ser Trp Gly Asp Glu Gly Thr Trp Ala Gly Arg Trp Gly Phe Asn Phe	260	265	270
gag acg ggg aat gtg ctc ttc ctc acc gag gag ggc cat gac ccc cag Glu Thr Gly Asn Val Leu Phe Leu Thr Glu Glu Gly His Asp Pro Gln	275	280	285
acg ggc gag gtg ttc gtc acc ctc ggc acg gag ggg tct ggc ctg cca Thr Gly Glu Val Phe Val Thr Leu Gly Thr Glu Gly Ser Gly Leu Pro	290	295	300
atc gtg ccg cag gtc tcc agt atc cac gat atg ctg tgg gcg gcg ggt Ile Val Pro Gln Val Ser Ile His Asp Met Leu Trp Ala Ala Gly	305	310	315
gag gtc ggg gtg ggc agt gag cag gag ggt gcc aag gtc gag ttc tcc Glu Val Gly Val Gly Ser Glu Gln Glu Gly Ala Lys Val Glu Phe Ser	325	330	335
ccc tcc atg gcc ggg ttt ctg gac tgg ggg ttc agc gcc tac gct gcg Pro Ser Met Ala Gly Phe Leu Asp Trp Gly Phe Ser Ala Tyr Ala Ala	340	345	350
gcg ggc aag gtg ctg ccg gcc agc tcg gcg gtg tcg aag acc agc ggc Ala Gly Lys Val Leu Pro Ala Ser Ser Ala Val Ser Lys Thr Ser Gly	355	360	365
gtg gag gtg gat cgg tat gtc tcg ttc gtc tgg ttg acg ggc gac cag Val Glu Val Asp Arg Tyr Val Ser Phe Val Trp Leu Thr Gly Asp Gln			

370	375	380	
tac gag cag gcg gac ggg ttc ccc acg gcc cag cag ggg tgg acg ggg Tyr Glu Gln Ala Asp Gly Phe Pro Thr Ala Gln Gln Gly Trp Thr Gly 385 390 395 400	1200		
tcg ctg ctg ctg ccg cgc gag ctg aag gtg cag acg gtg gag aac gtc Ser Leu Leu Leu Pro Arg Glu Leu Lys Val Gln Thr Val Glu Asn Val 405 410 415	1248		
gtc gac aac gag ctg gtg cgc gag gag ggc gtg tcg tgg gtg gtg ggg Val Asp Asn Glu Leu Val Arg Glu Glu Gly Val Ser Trp Val Val Gly 420 425 430	1296		
gag tcg gac aac cag acg gcc agg ctg cgc acg ctg ggg atc acg atc Glu Ser Asp Asn Gln Thr Ala Arg Leu Arg Thr Leu Gly Ile Thr Ile 435 440 445	1344		
gcc cgg gag acc aag gcg gcc ctg ctg gcc aac ggc tcg gtg acc gcg Ala Arg Glu Thr Lys Ala Ala Leu Leu Ala Asn Gly Ser Val Thr Ala 450 455 460	1392		
gag gag gac cgc acg ctg cag acg gcg gcc gtc gtg ccg ttc gcg caa Glu Glu Asp Arg Thr Leu Gln Thr Ala Ala Val Val Pro Phe Ala Gln 465 470 475 480	1440		
tcg ccg agc tcc aag ttc ttc gtg ctg acg gcc cag ctg gag ttc ccc Ser Pro Ser Ser Lys Phe Phe Val Leu Thr Ala Gln Leu Glu Phe Pro 485 490 495	1488		
gcg agc gcg cgc tcg tcc ccg ctc cag tcc ggg ttc gaa atc ctg gcg Ala Ser Ala Arg Ser Ser Pro Leu Gln Ser Gly Phe Glu Ile Leu Ala 500 505 510	1536		
tcg gag ctg gag cgc acg gcc atc tac tac cag ttc agc aac gag tcg Ser Glu Leu Glu Arg Thr Ala Ile Tyr Tyr Gln Phe Ser Asn Glu Ser 515 520 525	1584		
ctg gtc gtc gac cgc agc cag act agt gcg gcg gcg ccc acg aac ccc Leu Val Val Asp Arg Ser Gln Thr Ser Ala Ala Ala Pro Thr Asn Pro 530 535 540	1632		
ggg ctg gat agc ttt act gag tcc ggc aag ttg cgg ttg ttc gac gtg Gly Leu Asp Ser Phe Thr Glu Ser Gly Lys Leu Arg Leu Phe Asp Val 545 550 555 560	1680		
atc gag aac ggc cag gag cag gtc gag acg ttg gat ctc act gtc gtc Ile Glu Asn Gly Gln Glu Gln Val Glu Thr Leu Asp Leu Thr Val Val 565 570 575	1728		
gtg gat aac gcg gtt gtc gag gtg tat gcc aac ggg cgc ttt gcg ttg Val Asp Asn Ala Val Val Glu Val Tyr Ala Asn Gly Arg Phe Ala Leu 580 585 590	1776		
agc acc tgg gcg aga tcg tgg tac gac aac tcc acc cag atc cgc ttc Ser Thr Trp Ala Arg Ser Trp Tyr Asp Asn Ser Thr Gln Ile Arg Phe 595 600 605	1824		
ttc cac aac ggc gag ggc gag gtg cag ttc agg aat gtc tcc gtg tcg Phe His Asn Gly Glu Gly Glu Val Gln Phe Arg Asn Val Ser Val Ser 610 615 620	1872		
gag ggg ctc tat aac gcc tgg ccg gag aga aat Glu Gly Leu Tyr Asn Ala Trp Pro Glu Arg Asn 1905			

625

630

635

&lt;210&gt; 2

&lt;211&gt; 635

&lt;212&gt; PRT

&lt;213&gt; Aspergillus niger

&lt;400&gt; 2

Ser Tyr His Leu Asp Thr Thr Ala Pro Pro Pro Thr Asn Leu Ser Thr  
1 5 10 15

Leu Pro Asn Asn Thr Leu Phe His Val Trp Arg Pro Arg Ala His Ile  
20 25 30

Leu Pro Ala Glu Gly Gln Ile Gly Asp Pro Cys Ala His Tyr Thr Asp  
35 40 45

Pro Ser Thr Gly Leu Phe His Val Gly Phe Leu His Asp Gly Asp Gly  
50 55 60

Ile Ala Gly Ala Thr Thr Ala Asn Leu Ala Thr Tyr Thr Asp Thr Ser  
65 70 75 80

Asp Asn Gly Ser Phe Leu Ile Gln Pro Gly Gly Lys Asn Asp Pro Val  
85 90 95

Ala Val Phe Asp Gly Ala Val Ile Pro Val Gly Val Asn Asn Thr Pro  
100 105 110

Thr Leu Leu Tyr Thr Ser Val Ser Phe Leu Pro Ile His Trp Ser Ile  
115 120 125

Pro Tyr Thr Arg Gly Ser Glu Thr Gln Ser Leu Ala Val Ala Arg Asp  
130 135 140

Gly Gly Arg Arg Phe Asp Lys Leu Asp Gln Gly Pro Val Ile Ala Asp  
145 150 155 160

His Pro Phe Ala Val Asp Val Thr Ala Phe Arg Asp Pro Phe Val Phe  
165 170 175

Arg Ser Ala Lys Leu Asp Val Leu Leu Ser Leu Asp Glu Glu Val Ala  
180 185 190

Arg Asn Glu Thr Ala Val Gln Gln Ala Val Asp Gly Trp Thr Glu Lys  
195 200 205

Asn Ala Pro Trp Tyr Val Ala Val Ser Gly Gly Val His Gly Val Gly  
210 215 220

Pro Ala Gln Phe Leu Tyr Arg Gln Asn Gly Gly Asn Ala Ser Glu Phe  
225 230 235 240

Gln Tyr Trp Glu Tyr Leu Gly Glu Trp Trp Gln Glu Ala Thr Asn Ser  
245 250 255

Ser Trp Gly Asp Glu Gly Thr Trp Ala Gly Arg Trp Gly Phe Asn Phe  
260 265 270

Glu Thr Gly Asn Val Leu Phe Leu Thr Glu Glu Gly His Asp Pro Gln  
275 280 285

Thr Gly Glu Val Phe Val Thr Leu Gly Thr Glu Gly Ser Gly Leu Pro  
290 295 300

Ile Val Pro Gln Val Ser Ser Ile His Asp Met Leu Trp Ala Ala Gly  
305 310 315 320

Glu Val Gly Val Gly Ser Glu Gln Glu Gly Ala Lys Val Glu Phe Ser  
325 330 335

Pro Ser Met Ala Gly Phe Leu Asp Trp Gly Phe Ser Ala Tyr Ala Ala  
340 345 350

Ala Gly Lys Val Leu Pro Ala Ser Ser Ala Val Ser Lys Thr Ser Gly  
355 360 365

Val Glu Val Asp Arg Tyr Val Ser Phe Val Trp Leu Thr Gly Asp Gln  
370 375 380

Tyr Glu Gln Ala Asp Gly Phe Pro Thr Ala Gln Gln Gly Trp Thr Gly  
385 390 395 400

Ser Leu Leu Leu Pro Arg Glu Leu Lys Val Gln Thr Val Glu Asn Val  
405 410 415

Val Asp Asn Glu Leu Val Arg Glu Glu Gly Val Ser Trp Val Val Gly  
420 425 430

Glu Ser Asp Asn Gln Thr Ala Arg Leu Arg Thr Leu Gly Ile Thr Ile  
435 440 445

Ala Arg Glu Thr Lys Ala Ala Leu Leu Ala Asn Gly Ser Val Thr Ala  
450 455 460

Glu Glu Asp Arg Thr Leu Gln Thr Ala Ala Val Val Pro Phe Ala Gln  
465 470 475 480

Ser Pro Ser Ser Lys Phe Phe Val Leu Thr Ala Gln Leu Glu Phe Pro  
485 490 495

Ala Ser Ala Arg Ser Ser Pro Leu Gln Ser Gly Phe Glu Ile Leu Ala  
500 505 510

Ser Glu Leu Glu Arg Thr Ala Ile Tyr Tyr Gln Phe Ser Asn Glu Ser  
515 520 525

Leu Val Val Asp Arg Ser Gln Thr Ser Ala Ala Ala Pro Thr Asn Pro  
530 535 540

Gly Leu Asp Ser Phe Thr Glu Ser Gly Lys Leu Arg Leu Phe Asp Val  
545 550 555 560

Ile Glu Asn Gly Gln Glu Gln Val Glu Thr Leu Asp Leu Thr Val Val  
565 570 575

Val Asp Asn Ala Val Val Glu Val Tyr Ala Asn Gly Arg Phe Ala Leu  
580 585 590

Ser Thr Trp Ala Arg Ser Trp Tyr Asp Asn Ser Thr Gln Ile Arg Phe  
595 600 605

Phe His Asn Gly Glu Gly Glu Val Gln Phe Arg Asn Val Ser Val Ser  
610 615 620

Glu Gly Leu Tyr Asn Ala Trp Pro Glu Arg Asn  
625 630 635

<210> 3  
<211> 1809  
<212> DNA  
<213> Penicillium roqueforti

<220>  
<221> CDS  
<222> (1)..(1809)

<400> 3  
gtt gat ttc cat acc ccg att gac tat aac tcg gct ccg cca aac ctt 48  
Val Asp Phe His Thr Pro Ile Asp Tyr Asn Ser Ala Pro Pro Asn Leu  
1 5 10 15

tct acc ctg gca aac gca tct ctt ttc aag aca tgg aga ccc aga gcc 96  
Ser Thr Leu Ala Asn Ala Ser Leu Phe Lys Thr Trp Arg Pro Arg Ala  
20 25 30

cat ctt ctc cct cca tct ggg aac ata ggc gac ccg tgc ggg cac tat 144  
His Leu Leu Pro Pro Ser Gly Asn Ile Gly Asp Pro Cys Gly His Tyr  
35 40 45

acc gat ccc aag act ggt ctc ttc cac gtg ggt tgg ctt tac agt ggg Thr Asp Pro Lys Thr Gly Leu Phe His Val Gly Trp Leu Tyr Ser Gly	192
att tcg gga gcg aca acc gac gat ctc gtt acc tat aaa gac ctc aat Ile Ser Gly Ala Thr Thr Asp Asp Leu Val Thr Tyr Lys Asp Leu Asn	240
ccc gat gga gcc ccg tca att gtt gca gga gga aag aac gac cct ctt Pro Asp Gly Ala Pro Ser Ile Val Ala Gly Gly Lys Asn Asp Pro Leu	288
tct gtc ttc gat ggc tcg gtc att cca agc ggt ata gac ggc atg cca Ser Val Phe Asp Gly Ser Val Ile Pro Ser Gly Ile Asp Gly Met Pro	336
act ctt ctg tat acc tct gta tca tac ctc cca atc cac tgg tcc atc Thr Leu Leu Tyr Thr Ser Val Ser Tyr Leu Pro Ile His Trp Ser Ile	384
ccc tac acc cgg gga agc gag aca caa tcc ttg gcc gtt tcc tat gac Pro Tyr Thr Arg Gly Ser Glu Thr Gln Ser Leu Ala Val Ser Tyr Asp	432
ggt ggt cac aac ttc acc aag ctc aac caa ggg ccc gtg atc cct acg Gly Gly His Asn Phe Thr Lys Leu Asn Gln Gly Pro Val Ile Pro Thr	480
cct ccg ttt gct ctc aat gtc acc gct ttc cgt gac ccc tac gtt ttc Pro Pro Phe Ala Leu Asn Val Thr Ala Phe Arg Asp Pro Tyr Val Phe	528
caa agc cca att ctg gac aaa tct gtc aat agt acc caa gga aca tgg Gln Ser Pro Ile Leu Asp Lys Ser Val Asn Ser Thr Gln Gly Thr Trp	576
tat gtc gcc ata tct ggc ggt gtc cac ggt gtc gga cct tgt cag ttc Tyr Val Ala Ile Ser Gly Gly Val His Gly Val Gly Pro Cys Gln Phe	624
ctc tac cgt cag aac gac gca gat ttt caa tat tgg gaa tat ctc ggg Leu Tyr Arg Gln Asn Asp Ala Asp Phe Gln Tyr Trp Glu Tyr Leu Gly	672
caa tgg tgg aag gag ccc ctt aat acc act tgg gga aag ggt gac tgg Gln Trp Trp Lys Glu Pro Leu Asn Thr Thr Trp Gly Lys Gly Asp Trp	720
gcc ggg ggt tgg ggc ttc aac ttt gag gtt ggc aac gtc ttt agt ctg Ala Gly Gly Trp Gly Phe Asn Phe Glu Val Gly Asn Val Phe Ser Leu	768
aat gca gag ggg tat agt gaa gac ggc gag ata ttc ata acc ctc ggt Asn Ala Glu Gly Tyr Ser Glu Asp Gly Glu Ile Phe Ile Thr Leu Gly	816
gct gag ggt tcg gga ctt ccc atc gtt cct caa gtc tcc tct att cgc Ala Glu Gly Ser Gly Leu Pro Ile Val Pro Gln Val Ser Ser Ile Arg	864
gat atg ctg tgg gtg acc ggc aat gtc aca aat gac ggc tct gtc act Asp Met Leu Trp Val Thr Gly Asn Val Thr Asn Asp Gly Ser Val Thr	912

ttc aag cca acc atg gcg ggt gtg ctt gac tgg ggc gtg tcg gca tat	960
Phe Lys Pro Thr Met Ala Gly Val Leu Asp Trp Gly Val Ser Ala Tyr	
305 310 315 320	
gct gct gca ggc aag atc ttg ccg gcc agc tct cag gca tcc aca aag	1008
Ala Ala Ala Gly Lys Ile Leu Pro Ala Ser Ser Gln Ala Ser Thr Lys	
325 330 335	
agc ggt gcc ccc gat cgg ttc att tcc tat gtc tgg ctc act gga gat	1056
Ser Gly Ala Pro Asp Arg Phe Ile Ser Tyr Val Trp Leu Thr Gly Asp	
340 345 350	
cta ttc gag caa gtg aaa gga ttc cct acc gct caa caa aac tgg acc	1104
Leu Phe Glu Gln Val Lys Gly Phe Pro Thr Ala Gln Gln Asn Trp Thr	
355 360 365	
ggg gcc ctc tta ctg ccg cga gag ctg aat gtc cgc act atc tct aac	1152
Gly Ala Leu Leu Leu Pro Arg Glu Leu Asn Val Arg Thr Ile Ser Asn	
370 375 380	
gtg gtg gat aac gaa ctt tcg cgt gag tcc ttg aca tcg tgg cgc gtg	1200
Val Val Asp Asn Glu Leu Ser Arg Glu Ser Leu Thr Ser Trp Arg Val	
385 390 395 400	
gcc cgc gaa gac tct ggt cag atc gac ctt gaa aca atg gga atc tca	1248
Ala Arg Glu Asp Ser Gly Gln Ile Asp Leu Glu Thr Met Gly Ile Ser	
405 410 415	
att tcc agg gag act tac agc gct ctc aca tcc ggc tca tct ttt gtc	1296
Ile Ser Arg Glu Thr Tyr Ser Ala Leu Thr Ser Gly Ser Ser Phe Val	
420 425 430	
gag tct ggt aaa acg ttg tcg aat gct gga gca gtg ccc ttc aat acc	1344
Glu Ser Gly Lys Thr Leu Ser Asn Ala Gly Ala Val Pro Phe Asn Thr	
435 440 445	
tca ccc tca agc aag ttc ttc gtg ctg aca gca aat ata tct ttc ccg	1392
Ser Pro Ser Ser Lys Phe Phe Val Leu Thr Ala Asn Ile Ser Phe Pro	
450 455 460	
acc tct gcc cgt gac tct ggc atc cag gct ggt ttc cag gtt tta tcc	1440
Thr Ser Ala Arg Asp Ser Gly Ile Gln Ala Gly Phe Gln Val Leu Ser	
465 470 475 480	
tct agt ctt gag tct aca act atc tac tac caa ttc tcc aac gag tcc	1488
Ser Ser Leu Glu Ser Thr Thr Ile Tyr Gln Phe Ser Asn Glu Ser	
485 490 495	
atc atc gtc gac cgc agc aac acg agt gct gcg gcg aga aca act gct	1536
Ile Ile Val Asp Arg Ser Asn Thr Ser Ala Ala Ala Arg Thr Thr Ala	
500 505 510	
ggg atc ctc agt gat aac gag gcg gga cgt ctg cgc ctc ttc gac gtg	1584
Gly Ile Leu Ser Asp Asn Glu Ala Gly Arg Leu Arg Leu Phe Asp Val	
515 520 525	
ttg cga aat gga aaa gaa cag gtt gaa act ttg gag ctc act atc gtg	1632
Leu Arg Asn Gly Lys Glu Gln Val Glu Thr Leu Glu Leu Thr Ile Val	
530 535 540	
gtg gat aat agt gta ctg gaa gta tat gcc aat gga cgc ttt gct cta	1680
Val Asp Asn Ser Val Leu Glu Val Tyr Ala Asn Gly Arg Phe Ala Leu	
545 550 555 560	



ggc act tgg gct cgg tct tgg tac gcc aac tcg act aaa att aac ttc 1728  
 Gly Thr Trp Ala Arg Ser Trp Tyr Ala Asn Ser Thr Lys Ile Asn Phe  
 565 570 575

ttc cat aac ggc gtg gga gaa gcg aca ttc gaa gat gtg acg gtc ttt 1776  
 Phe His Asn Gly Val Gly Glu Ala Thr Phe Glu Asp Val Thr Val Phe  
 580 585 590

gaa gga ctg tat gat gcc tgg cca caa agg aag 1809  
 Glu Gly Leu Tyr Asp Ala Trp Pro Gln Arg Lys  
 595 600

<210> 4  
 <211> 603  
 <212> PRT  
 <213> Penicillium roqueforti

<400> 4

Val Asp Phe His Thr Pro Ile Asp Tyr Asn Ser Ala Pro Pro Asn Leu  
 1 5 10 15

Ser Thr Leu Ala Asn Ala Ser Leu Phe Lys Thr Trp Arg Pro Arg Ala  
 20 25 30

His Leu Leu Pro Pro Ser Gly Asn Ile Gly Asp Pro Cys Gly His Tyr  
 35 40 45

Thr Asp Pro Lys Thr Gly Leu Phe His Val Gly Trp Leu Tyr Ser Gly  
 50 55 60

Ile Ser Gly Ala Thr Thr Asp Asp Leu Val Thr Tyr Lys Asp Leu Asn  
 65 70 75 80

Pro Asp Gly Ala Pro Ser Ile Val Ala Gly Gly Lys Asn Asp Pro Leu  
 85 90 95

Ser Val Phe Asp Gly Ser Val Ile Pro Ser Gly Ile Asp Gly Met Pro  
 100 105 110

Thr Leu Leu Tyr Thr Ser Val Ser Tyr Leu Pro Ile His Trp Ser Ile  
 115 120 125

Pro Tyr Thr Arg Gly Ser Glu Thr Gln Ser Leu Ala Val Ser Tyr Asp  
 130 135 140

Gly Gly His Asn Phe Thr Lys Leu Asn Gln Gly Pro Val Ile Pro Thr  
 145 150 155 160

Pro Pro Phe Ala Leu Asn Val Thr Ala Phe Arg Asp Pro Tyr Val Phe  
 165 170 175

Gln Ser Pro Ile Leu Asp Lys Ser Val Asn Ser Thr Gln Gly Thr Trp  
 180 185 190  
 Tyr Val Ala Ile Ser Gly Gly Val His Gly Val Gly Pro Cys Gln Phe  
 195 200 205  
 Leu Tyr Arg Gln Asn Asp Ala Asp Phe Gln Tyr Trp Glu Tyr Leu Gly  
 210 215 220  
 Gln Trp Trp Lys Glu Pro Leu Asn Thr Thr Trp Gly Lys Gly Asp Trp  
 225 230 235 240  
 Ala Gly Gly Trp Gly Phe Asn Phe Glu Val Gly Asn Val Phe Ser Leu  
 245 250 255  
 Asn Ala Glu Gly Tyr Ser Glu Asp Gly Glu Ile Phe Ile Thr Leu Gly  
 260 265 270  
 Ala Glu Gly Ser Gly Leu Pro Ile Val Pro Gln Val Ser Ser Ile Arg  
 275 280 285  
 Asp Met Leu Trp Val Thr Gly Asn Val Thr Asn Asp Gly Ser Val Thr  
 290 295 300  
 Phe Lys Pro Thr Met Ala Gly Val Leu Asp Trp Gly Val Ser Ala Tyr  
 305 310 315 320  
 Ala Ala Ala Gly Lys Ile Leu Pro Ala Ser Ser Gln Ala Ser Thr Lys  
 325 330 335  
 Ser Gly Ala Pro Asp Arg Phe Ile Ser Tyr Val Trp Leu Thr Gly Asp  
 340 345 350  
 Leu Phe Glu Gln Val Lys Gly Phe Pro Thr Ala Gln Gln Asn Trp Thr  
 355 360 365  
 Gly Ala Leu Leu Leu Pro Arg Glu Leu Asn Val Arg Thr Ile Ser Asn  
 370 375 380  
 Val Val Asp Asn Glu Leu Ser Arg Glu Ser Leu Thr Ser Trp Arg Val  
 385 390 395 400  
 Ala Arg Glu Asp Ser Gly Gln Ile Asp Leu Glu Thr Met Gly Ile Ser  
 405 410 415  
 Ile Ser Arg Glu Thr Tyr Ser Ala Leu Thr Ser Gly Ser Ser Phe Val  
 420 425 430

Glu Ser Gly Lys Thr Leu Ser Asn Ala Gly Ala Val Pro Phe Asn Thr  
 435 440 445  
 Ser Pro Ser Ser Lys Phe Phe Val Leu Thr Ala Asn Ile Ser Phe Pro  
 450 455 460  
 Thr Ser Ala Arg Asp Ser Gly Ile Gln Ala Gly Phe Gln Val Leu Ser  
 465 470 475 480  
 Ser Ser Leu Glu Ser Thr Thr Ile Tyr Tyr Gln Phe Ser Asn Glu Ser  
 485 490 495  
 Ile Ile Val Asp Arg Ser Asn Thr Ser Ala Ala Ala Arg Thr Thr Ala  
 500 505 510  
 Gly Ile Leu Ser Asp Asn Glu Ala Gly Arg Leu Arg Leu Phe Asp Val  
 515 520 525  
 Leu Arg Asn Gly Lys Glu Gln Val Glu Thr Leu Glu Leu Thr Ile Val  
 530 535 540  
 Val Asp Asn Ser Val Leu Glu Val Tyr Ala Asn Gly Arg Phe Ala Leu  
 545 550 555 560  
 Gly Thr Trp Ala Arg Ser Trp Tyr Ala Asn Ser Thr Lys Ile Asn Phe  
 565 570 575  
 Phe His Asn Gly Val Gly Glu Ala Thr Phe Glu Asp Val Thr Val Phe  
 580 585 590  
 Glu Gly Leu Tyr Asp Ala Trp Pro Gln Arg Lys  
 595 600

<210> 5  
 <211> 1839  
 <212> DNA  
 <213> *Scopulariopsis brevicaulis*

<220>  
 <221> CDS  
 <222> (1)..(1839)

<400>	5																	
caa	cct	acg	tct	ctg	tca	atc	gac	aat	tcc	acg	tat	cct	tct	atc	gac			
Gln	Pro	Thr	Ser	Leu	Ser	Ile	Asp	Asn	Ser	Thr	Tyr	Pro	Ser	Ile	Asp			48
1				5					10					15				
tac	aac	tcc	gcc	cct	cca	aac	ctc	tcg	act	ctt	gcc	aac	aac	agc	ctc			
Tyr	Asn	Ser	Ala	Pro	Pro	Asn	Leu	Ser	Thr	Leu	Ala	Asn	Asn	Ser	Leu			96
			20					25					30					

ttc gag aca tgg agg ccg agg gca cac gtc ctt ccg ccc cag aac cag	144
Phe Glu Thr 35 Trp Arg Pro Arg Ala 40 His Val Leu Pro Pro Gln Asn Gln	
atc ggc gat ccg tgt atg cac tac acc gac ccc gag aca gga atc ttc	192
Ile Gly 50 Asp Pro Cys Met 55 His Tyr Thr Asp Pro Glu Thr Gly Ile Phe	
cac gtc ggc tgg ctg tac aac ggc aat ggc gct tcc ggc gcc acg acc	240
His Val Gly Trp Leu Tyr 70 Asn Gly Asn Gly Ala 75 Ser Gly Ala Thr Thr 80	
gag gat ctc gtc acc tat cag gat ctc aac ccc gac gga gcg cag atg	288
Glu Asp Leu Val Thr 85 Tyr Gln Asp Leu Asn 90 Pro Asp Gly Ala Gln Met	
atc ctt ccg ggt ggt gtg aat gac ccc att gct gtc ttt gac ggc gcg	336
Ile Leu Pro Gly 100 Gly Val Asn Asp Pro 105 Ile Ala Val Phe 110 Asp Gly Ala	
gtt att ccc agt ggc att gat ggg aaa ccc acc atg atg tat acc tcg	384
Val Ile Pro Ser Gly Ile Asp Gly Lys Pro Thr Met Met Tyr Thr Ser	
gtg tca tac atg ccc atc tcc tgg agc atc gct tac acc agg gga agc	432
Val Ser Tyr Met Pro Ile Ser Trp Ser Ile Ala Tyr Thr Arg Gly Ser	
gag acc cac tct ctc gca gtg tcg tcc gac ggc ggt aag aac ttc acc	480
Glu Thr His Ser Leu Ala 150 Val Ser Ser Asp Gly 155 Gly Lys Asn Phe Thr 160	
aag ctg gtg cag ggc ccc gtc att cct tcg cct ccc ttc ggc gcc aac	528
Lys Leu Val Gln Gly 165 Pro Val Ile Pro Ser 170 Pro Pro Phe Gly Ala Asn	
gtg acc agc tgg cgt gac ccc ttc ctg ttc caa aac ccc cag ttc gac	576
Val Thr Ser Trp Arg Asp Pro Phe Leu Phe Gln Asn Pro Gln Phe Asp	
tct ctc ctc gaa agc gag aac ggc acg tgg tac acc gtt atc tct ggt	624
Ser Leu Leu 195 Glu Ser Glu Asn Gly 200 Thr Trp Tyr Thr 205 Val Ile Ser Gly	
ggc atc cac ggt gac ggc ccc tcc gcg ttc ctc tac cgt cag cac gac	672
Gly Ile His Gly Asp Gly Pro 215 Ser Ala Phe Leu Tyr Arg Gln His Asp	
ccc gac ttc cag tac tgg gag tac ctt gga ccg tgg tgg aac gag gaa	720
Pro Asp Phe Gln Tyr Trp 230 Glu Tyr Leu Gly Pro Trp Trp Asn Glu Glu 240	
ggg aac tcg acc tgg ggc agc ggt gac tgg gct ggc cgg tgg ggc tac	768
Gly Asn Ser Thr Trp 245 Gly Ser Gly Asp Trp 250 Ala Gly Arg Trp 255 Gly Tyr	
aac ttc gag gtc atc aac att gtc ggt ctt gac gat gat ggc tac aac	816
Asn Phe Glu Val Ile Asn Ile Val Gly 265 Gly Leu Asp Asp Asp Gly Tyr Asn	
ccc gac ggt gaa atc ttt gcc acg gta ggt acc gaa tgg tcg ttt gac	864
Pro Asp Gly 275 Glu Ile Phe Ala Thr 280 Val Gly Thr Glu Trp Ser Phe Asp	

ccc Pro 290	atc Ile	aaa Lys	ccg Pro	cag Gln	gcc Ala 295	tcg Ser	gac Asp	aac Asn	agg Arg	gag Glu 300	atg Met	ctc Leu	tgg Trp	gcc Ala	gcg Ala	912
ggc Gly 305	aac Asn	atg Met	act Thr	ctc Leu	gag Glu 310	gac Asp	ggc Gly	gat Asp	atc Ile	aag Lys 315	ttc Phe	acg Thr	cca Pro	agc Ser	atg Met 320	960
gcg Ala	ggc Gly	tac Tyr	ctc Leu	gac Asp 325	tgg Trp	ggt Gly	cta Leu	tcg Ser	gcg Ala 330	tat Tyr	gcc Ala	gcc Ala	gct Ala	ggc Gly 335	aag Lys	1008
gag Glu	ctg Leu	ccc Pro	gct Ala 340	tct Ser	tca Ser	aag Lys	cct Pro	tcg Ser 345	cag Gln	aag Lys	agc Ser	ggt Gly	gcg Ala 350	ccg Pro	gac Asp	1056
cgg Arg	ttc Phe	gtg Val 355	tcg Ser	tac Tyr	ctg Leu	tgg Trp	ctc Leu 360	acc Thr	ggt Gly	gac Asp	tac Tyr	ttc Phe 365	gag Glu	ggc Gly	cac His	1104
gac Asp 370	ttc Phe	ccc Pro	acc Thr	ccg Pro	cag Gln	cag Gln 375	aat Asn	tgg Trp	acc Thr	ggc Gly	tcg Ser 380	ctt Leu	ttg Leu	ctt Leu	ccg Pro	1152
cgt Arg 385	gag Glu	ctg Leu	agc Ser	gtc Val	ggg Gly 390	acg Thr	att Ile	ccc Pro	aac Asn	gtt Val 395	gtc Val	gac Asp	aac Asn	gag Glu	ctt Leu 400	1200
gct Ala	cgc Arg	gag Glu	acg Thr	ggc Gly 405	tct Ser	tgg Trp	agg Arg	gtt Val	ggc Gly 410	acc Thr	aac Asn	gac Asp	act Thr	ggc Gly 415	gtg Val	1248
ctt Leu	gag Glu	ctg Leu	gtc Val 420	act Thr	ctg Leu	aag Lys	cag Gln	gag Glu 425	att Ile	gct Ala	cgc Arg	gag Glu	acg Thr 430	ctg Leu	gct Ala	1296
gaa Glu	atg Met	acc Thr 435	agc Ser	ggc Gly	aac Asn	tcc Ser	ttc Phe 440	acc Thr	gag Glu	gcg Ala	agc Ser	agg Arg 445	aat Asn	gtc Val	agc Ser	1344
tcg Ser 450	ccc Pro	gga Gly	tct Ser	acc Thr	gcc Ala	ttc Phe 455	cag Gln	cag Gln	tcc Ser	ctg Leu	gat Asp 460	tcc Ser	aag Lys	ttc Phe	ttc Phe	1392
gtc Val 465	ctg Leu	acc Thr	gcc Ala	tcg Ser	ctc Leu 470	tcc Ser	ttc Phe	cct Pro	tcg Ser	tcg Ser 475	gct Ala	cgc Arg	gac Asp	tcc Ser	gac Asp 480	1440
ctc Leu	aag Lys	gct Ala	ggt Gly	ttc Phe 485	gag Glu	atc Ile	ctg Leu	tcg Ser	tcc Ser 490	gag Glu	ttt Phe	gag Glu	tcg Ser	acc Thr 495	acg Thr	1488
gtc Val	tac Tyr	tac Tyr	cag Gln 500	ttt Phe	tcc Ser	aac Asn	gag Glu	tcc Ser 505	atc Ile	atc Ile	att Ile	gac Asp	cgg Arg 510	agc Ser	aac Asn	1536
tcg Ser	agt Ser	gct Ala 515	gcc Ala	gcc Ala	ttg Leu	act Thr	acc Thr 520	gat Asp	gga Gly	atc Ile	gac Asp	acc Thr 525	cgc Arg	aac Asn	gag Glu	1584
ttt Phe 530	ggc Gly	aag Lys	atg Met	cgc Arg	ctg Leu	ttt Phe 535	gat Asp	gtt Val	gtc Val	gag Glu	ggt Gly 540	gac Asp	cag Gln	gag Glu	cgt Arg	1632

atc gag acg ctc gat ctc act att gtg gtt gat aac tcg atc gtt gag	1680
Ile Glu Thr Leu Asp Leu Thr Ile Val Val Asp Asn Ser Ile Val Glu	
545 550 555 560	
gtt cat gcc aac ggg cga ttc gct ctg agc act tgg gtt cgt tcg tgg	1728
Val His Ala Asn Gly Arg Phe Ala Leu Ser Thr Trp Val Arg Ser Trp	
565 570 575	
tac gag tcg tcc aag gac atc aag ttc ttc cac gat ggc gac agc acg	1776
Tyr Glu Ser Ser Lys Asp Ile Lys Phe Phe His Asp Gly Asp Ser Thr	
580 585 590	
gtt cag ttc tcg aac atc acc gtc tac gag gga ctg ttt gac gcc tgg	1824
Val Gln Phe Ser Asn Ile Thr Val Tyr Glu Gly Leu Phe Asp Ala Trp	
595 600 605	
ccg gag cgg gcc agg	1839
Pro Glu Arg Ala Arg	
610	

<210> 6  
 <211> 613  
 <212> PRT  
 <213> *Scopulariopsis brevicaulis*

<400> 6

Gln Pro Thr Ser Leu Ser Ile Asp Asn Ser Thr Tyr Pro Ser Ile Asp	
1 5 10 15	
Tyr Asn Ser Ala Pro Pro Asn Leu Ser Thr Leu Ala Asn Asn Ser Leu	
20 25 30	
Phe Glu Thr Trp Arg Pro Arg Ala His Val Leu Pro Pro Gln Asn Gln	
35 40 45	
Ile Gly Asp Pro Cys Met His Tyr Thr Asp Pro Glu Thr Gly Ile Phe	
50 55 60	
His Val Gly Trp Leu Tyr Asn Gly Asn Gly Ala Ser Gly Ala Thr Thr	
65 70 75 80	
Glu Asp Leu Val Thr Tyr Gln Asp Leu Asn Pro Asp Gly Ala Gln Met	
85 90 95	
Ile Leu Pro Gly Gly Val Asn Asp Pro Ile Ala Val Phe Asp Gly Ala	
100 105 110	
Val Ile Pro Ser Gly Ile Asp Gly Lys Pro Thr Met Met Tyr Thr Ser	
115 120 125	
Val Ser Tyr Met Pro Ile Ser Trp Ser Ile Ala Tyr Thr Arg Gly Ser	
130 135 140	

Glu Thr His Ser Leu Ala Val Ser Ser Asp Gly Gly Lys Asn Phe Thr  
 145 150 155 160  
 Lys Leu Val Gln Gly Pro Val Ile Pro Ser Pro Pro Phe Gly Ala Asn  
 165 170 175  
 Val Thr Ser Trp Arg Asp Pro Phe Leu Phe Gln Asn Pro Gln Phe Asp  
 180 185 190  
 Ser Leu Leu Glu Ser Glu Asn Gly Thr Trp Tyr Thr Val Ile Ser Gly  
 195 200 205  
 Gly Ile His Gly Asp Gly Pro Ser Ala Phe Leu Tyr Arg Gln His Asp  
 210 215 220  
 Pro Asp Phe Gln Tyr Trp Glu Tyr Leu Gly Pro Trp Trp Asn Glu Glu  
 225 230 235 240  
 Gly Asn Ser Thr Trp Gly Ser Gly Asp Trp Ala Gly Arg Trp Gly Tyr  
 245 250 255  
 Asn Phe Glu Val Ile Asn Ile Val Gly Leu Asp Asp Asp Gly Tyr Asn  
 260 265 270  
 Pro Asp Gly Glu Ile Phe Ala Thr Val Gly Thr Glu Trp Ser Phe Asp  
 275 280 285  
 Pro Ile Lys Pro Gln Ala Ser Asp Asn Arg Glu Met Leu Trp Ala Ala  
 290 295 300  
 Gly Asn Met Thr Leu Glu Asp Gly Asp Ile Lys Phe Thr Pro Ser Met  
 305 310 315 320  
 Ala Gly Tyr Leu Asp Trp Gly Leu Ser Ala Tyr Ala Ala Ala Gly Lys  
 325 330 335  
 Glu Leu Pro Ala Ser Ser Lys Pro Ser Gln Lys Ser Gly Ala Pro Asp  
 340 345 350  
 Arg Phe Val Ser Tyr Leu Trp Leu Thr Gly Asp Tyr Phe Glu Gly His  
 355 360 365  
 Asp Phe Pro Thr Pro Gln Gln Asn Trp Thr Gly Ser Leu Leu Leu Pro  
 370 375 380  
 Arg Glu Leu Ser Val Gly Thr Ile Pro Asn Val Val Asp Asn Glu Leu  
 385 390 395 400

Ala Arg Glu Thr Gly Ser Trp Arg Val Gly Thr Asn Asp Thr Gly Val  
 405 410 415  
 Leu Glu Leu Val Thr Leu Lys Gln Glu Ile Ala Arg Glu Thr Leu Ala  
 420 425 430  
 Glu Met Thr Ser Gly Asn Ser Phe Thr Glu Ala Ser Arg Asn Val Ser  
 435 440 445  
 Ser Pro Gly Ser Thr Ala Phe Gln Gln Ser Leu Asp Ser Lys Phe Phe  
 450 455 460  
 Val Leu Thr Ala Ser Leu Ser Phe Pro Ser Ser Ala Arg Asp Ser Asp  
 465 470 475 480  
 Leu Lys Ala Gly Phe Glu Ile Leu Ser Ser Glu Phe Glu Ser Thr Thr  
 485 490 495  
 Val Tyr Tyr Gln Phe Ser Asn Glu Ser Ile Ile Ile Asp Arg Ser Asn  
 500 505 510  
 Ser Ser Ala Ala Ala Leu Thr Thr Asp Gly Ile Asp Thr Arg Asn Glu  
 515 520 525  
 Phe Gly Lys Met Arg Leu Phe Asp Val Val Glu Gly Asp Gln Glu Arg  
 530 535 540  
 Ile Glu Thr Leu Asp Leu Thr Ile Val Val Asp Asn Ser Ile Val Glu  
 545 550 555 560  
 Val His Ala Asn Gly Arg Phe Ala Leu Ser Thr Trp Val Arg Ser Trp  
 565 570 575  
 Tyr Glu Ser Ser Lys Asp Ile Lys Phe Phe His Asp Gly Asp Ser Thr  
 580 585 590  
 Val Gln Phe Ser Asn Ile Thr Val Tyr Glu Gly Leu Phe Asp Ala Trp  
 595 600 605  
 Pro Glu Arg Ala Arg  
 610

<210> 7  
 <211> 27  
 <212> DNA  
 <213> Artificial sequence  
 <220>  
 <223> oligonucleotide



<400> 7  
gcgaattcat gaagtcacc actacca

27

<210> 8  
<211> 22  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> oligonucleotide

<400> 8  
gcggatcccg gtcaatttct ct

22

<210> 9  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 9  
gac gag gac  
Asp Glu Asp  
1

9

<210> 10  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 10  
ttc atg ccc  
Phe Met Pro  
1

9

<210> 11  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 11  
tcc aac ccc  
Ser Asn Pro  
1

9

<210> 12  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 12  
gcc ttc gac  
Ala Phe Asp  
1

9

<210> 13  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 13  
gtg tac ggc  
Val Tyr Gly  
1

9

<210> 14  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 14  
gcc ctg cag  
Ala Leu Gln  
1

9

<210> 15  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 15  
ttt tcg gag  
Phe Ser Glu  
1

9

<210> 16  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 16  
atc gac gac  
Ile Asp Asp  
1

9

<210> 17  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 17  
ttg atg ggc  
Leu Met Gly  
1

9

<210> 18  
<211> 9  
<212> DNA  
<213> Aspergillus niger

<220>  
<221> CDS  
<222> (1)..(9)

<400> 18  
gtc tgc ttg  
Val Cys Leu  
1

9